



Motorcycle Parts

NASA *Tech Briefs* is a monthly publication used as a problem solving tool by more than 200,000 government and industry readers (see page 141). Each issue reports on newly developed products/processes and on innovative technologies originating in NASA research. Readers interested in adapting a particular innovation to their own purposes can get more detailed information from NASA by requesting a Technical Support Package (TSP).

Tech Briefs has become a prime source of spinoff applications. An indication that the publication's information is

being widely employed is the fact that NASA annually fills some 135,000 requests for TSPs.

Sometimes it happens that the information supplied in a *Tech Briefs* article is by itself sufficient to generate a spinoff application without need for the TSP. An example is the experience of a small firm — Performance Extremes R&D, Norman, Oklahoma — producing motorcycle parts. It is a particularly interesting example because none of the three partners in the company is an engineer and, as president Larry Ortega admits, “many of the articles in *NASA Tech Briefs* are over our heads.” Nonetheless,

the group was able to use the information in one *Tech Briefs* article to substantially improve their manufacturing process for motorcycle parts.

The company was started on the idea of making motorcycle parts out of carbon/epoxy to reduce part weight. “Our first attempts were pitiful,” Ortega reports. A friend introduced him to *NASA Tech Briefs*, specifically an article that detailed a vacuum bagging process for forming composite parts. At that point, no one in Performance Extremes had heard of vacuum bagging, but they bought a vacuum pump the next day and started using the process described in *Tech Briefs*. At left, Ortega is “prepping” a part; it is placed in a vacuum bag, drawn under vacuum with a pump, then heat-cured in a radiant oven.

“Using vacuum bags, our parts came out with a better surface and far fewer voids inside,” Ortega says. “But we still had a problem; parts were warping after cooling.” The epoxy being used did not respond well to heating lamps; uneven heating caused spots to deform upon cooling. The group went to the University of Oklahoma library and scanned back issues of *Tech Briefs* looking for an answer — and they found one: a researcher had discovered that a metal plate inside the vacuum bag made for more even heat transfer.

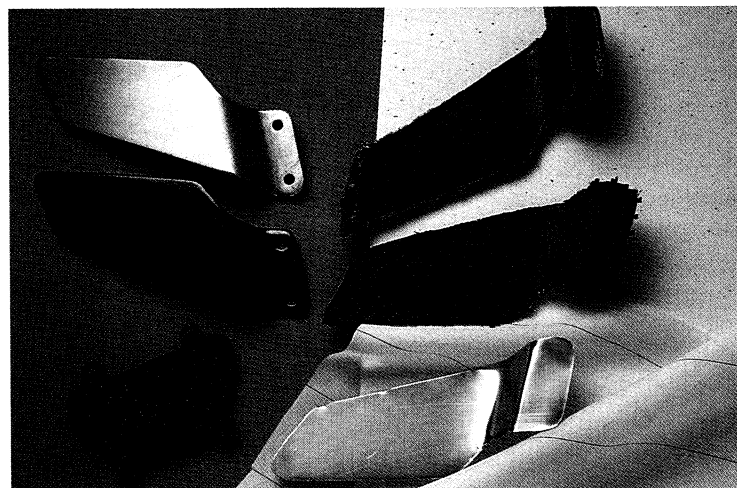
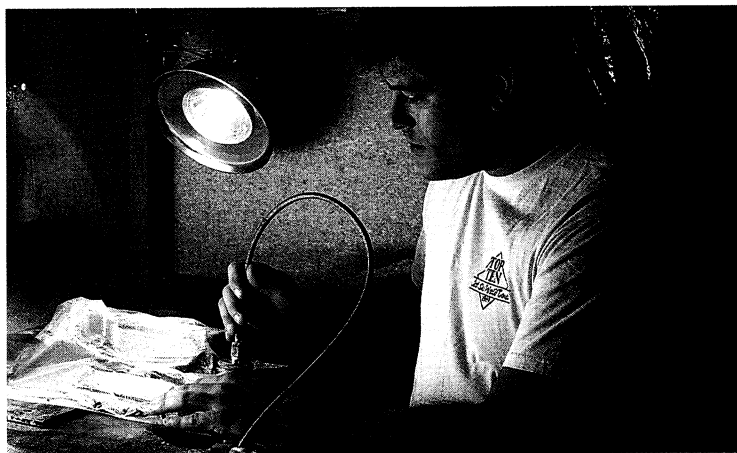
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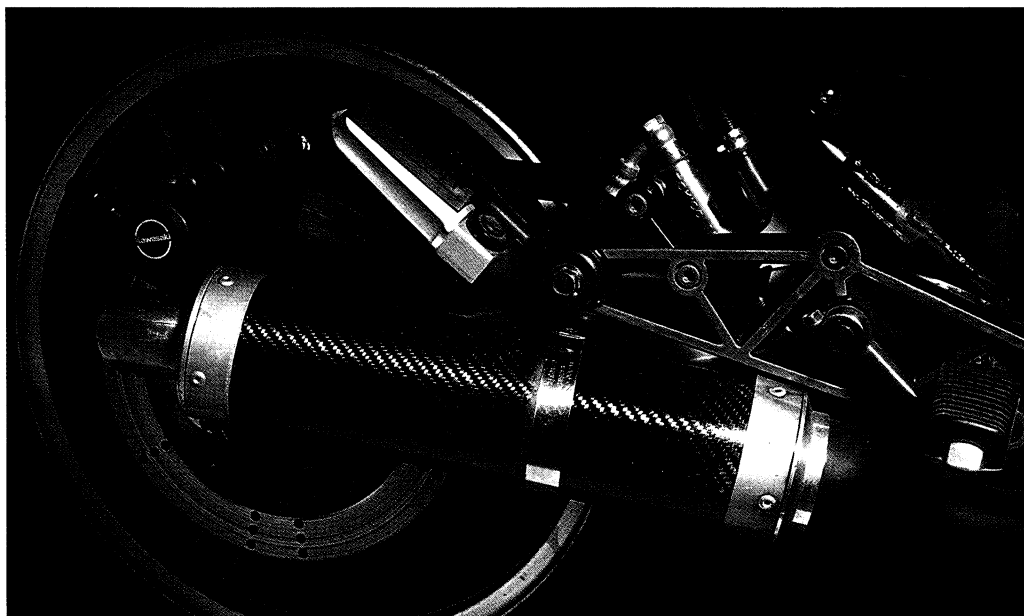
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They tried it using a one-eighth-inch thick copper plate in the vacuum bag. After curing under the same heat lamps and the same processing conditions, the cooled part was perfect.

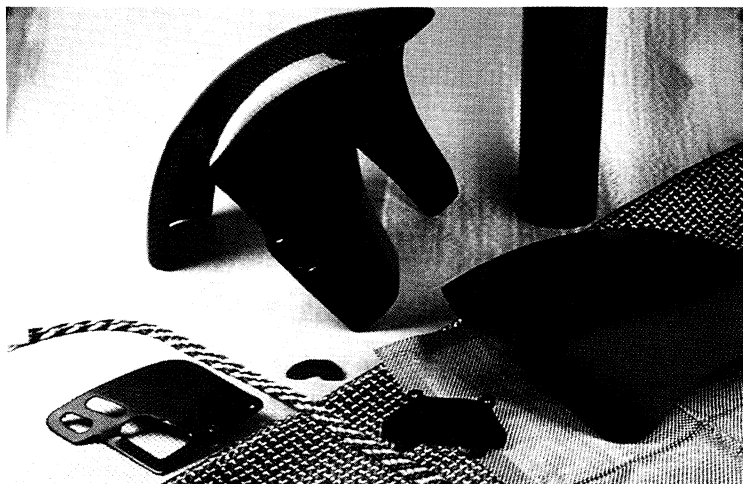
"We still use a vacuum bag with a copper sheet to cure prototype parts," says Ortega. "There has been no problem."

At left are the components of a typical part, various layers of material which are cut and placed in a mold; a similarly-shaped piece of copper is placed over the assembled composite to ensure even heat distribution. *Above* is an example of a finished Performance Extremes part, a muffler installed on a motorcycle, and *at right* is a sampling of parts and some of the materials from which they are made.

Performance Extremes found another useful technique in *Tech Briefs*. Ortega explains: "We work on a number of motorcycles and have found that over time the multiple wire

wire. Performance Extremes is now using that technique to advantage.

Larry Ortega no longer has to go to the university for his *Tech Briefs* research; he is now a subscriber and an appreciative one who says, "When we need technical information, *Tech Briefs* is the first source we turn to." •



connectors come loose. Replacing a multiple connector takes a lot of man-hours and is not always a sure cure. We went back to *Tech Briefs* and started digging."

And again they got an answer. A *Tech Briefs* article described a simple procedure for repairing loose connector pins rather than replacing them: use of a hypodermic needle to inject epoxy into a fault connection; when the epoxy dries, there is no play in the